

CENTER FOR BEAM PHYSICS SEMINAR

“Supercomputing Applications in Beam Dynamics”

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Albert Ghiorso Conference Rm. (71-264), LBNL

Refreshments served at 10:20 AM

Abstract: Many problems in beam dynamics, i.e. the interaction of bunches of charged particles in accelerators, require numerical methods for their solution. The National Energy Research Scientific Computing Center (NERSC) provides some of its parallel computing facilities for the solution of problems in beam dynamics, making it possible to tackle problems whose solution was not feasible before. Two such applications will be presented:

(1) *Coherent Synchrotron Radiation (CSR)*: This is a collective effect disturbing the trajectories of short bunches of charged particles traveling on curved trajectories. While analytic results have been obtained for some simple cases, real-world setups require numerical methods. An approach starting from first principles, namely by solving the complete Maxwell equations by means of retarded fields and weighted macroparticles, will be presented. Comparison with experimental results will be given.

(2) *Strong-Strong Beam-Beam Effect*: When an ultra-relativistic bunches pass each other head-on, they will experience a distortion of their trajectories which will be dominated by the transverse electric field of the opposing bunch. This leads to a degradation of luminosity in storage rings over time; the effect is a crucial problem for the operation of the SLAC PEP-II accelerator. An adequate simulation is highly demanding in terms of CPU time. We present first results from a parallel particle-in-cell algorithm and their comparison with experiments.

Biographical Sketch: Andreas Kabel obtained his Ph.D. from the University of Heidelberg, Germany, for work on multi-particle theory. During 1997-1999 he was a Postdoctoral Fellow at DESY, where he worked on the computer simulation of coherent synchrotron radiation, and on the TESLA Test Facility. Since 1999 he has been a Research Associate at SLAC, where he has continued his work on coherent synchrotron radiation. In addition, he works on quantum limits of beam physics and computer simulations.